REMARKS

The foregoing amendments are made to improve the form of the patent application. No new matter has been added and entry is respectfully requested.

A favorable Action on the merits is solicited.

Respectfully submitted,

LEYDIG, VOIT & MAYER, LTD.

Jeffrey A. Wyand,
Registration No. 29,458

Suite 300
700 Thirteenth Street, N. W.
Washington, D. C. 20005
Telephone: (202) 737-6770
Facsimile: (202) 737-6776
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JAW:cmcg

PATENT
Attorney Docket No. 401088

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

x In re Application of:

HU et al.

Application No.:	09/778,857	Art Unit:	Unassigned
Filed:	February 8, 2001	Examiner:	Unassigned
For:	THREE DIMENSIONAL MEASUREMENT, EVALUATION AND GRADING SYSTEM FOR FABRIC/ TEXTILE STRUCTURE/ GARMENT APPEARANCE		

SPECIFICATION, CLAIMS AND
ABSTRACT AS PRELIMINARILY AMENDED

Amendments to the paragraph beginning at page 1, line 13:

Fabric/garment/textile structure appearance includes many aspects such as pilling, wrinkling, seam puckering, and so forth. Although the invention applies to different aspects of fabric/textile structure/garment appearance, we explain below the effect of wrinkling on appearance. Wrinkles are three dimensional versions of ~~crease~~ creases, and form when fabrics are forced to develop high levels of double curvature, which result in some degree of permanent in-plane and out-of-plane deformations. Due to the importance of wrinkle recovery in the appearance of garments or textiles, many methods of assessment have been developed since the early 1950s. One of the most widely used in U.S. is the AATCC Test method. This method allows expert observers to compare fabric specimens with a set of six three-dimensional ~~replica~~ replicas supplied by the American Association of Textile Chemists and ~~colorist~~ Colorists (AATCC), and then assign a grade according to their similarity.

Amendments to the paragraph beginning at page 2, line 3:

Many attempts have been mode to automate this characterization process using imaging technology instead of visual observations. Laser ~~probe~~ probing is one way of evaluation of a fabric specimen to measure surface height variations. It incorporates obvious physical meaning and is not influenced by color and pattern in the specimen. However, point-scanning and costs ~~makes~~ make the method too slow and too expensive for industrial applications. A ~~Video~~ video camera with a common lighting system can be used, to obtain good resolution images of fabric specimens and is faster than using a laser probe, but it is sensitive to fabric colors and patterns, so its application is also limited by its ability to evaluate only fabrics without patterns or designs. A line laser profilometer can be ~~need~~ used to improve the detecting efficiency, but line profiles cannot cover ~~of~~ a whole fabric surface, and typically sixteen images per sample are needed to produce reliable results

Amendments to the paragraph beginning at page 5, line 5:

A method and apparatus measuring wrinkling according to the invention will now be described by way of example with reference to the ~~accompany~~ accompanying drawings in which:

Amendments to the paragraph beginning at page 5, line 16:

~~Figure~~Figures 5(a) and 5(b) are ~~an~~ illustrations of depth conversion order for points on a specimen surface;

Amendments to the existing claims:

1. (Amended) A method of ~~3D~~ three-dimensional measurement, evaluation, and grading ~~system for~~ of fabric/textile structure/garment appearance, the method comprising ~~using~~:

with a fixed digital camera positioned above a piece of ~~the~~ fabric, shining at least two different parallel light beams from inclined directions ~~on to the~~ onto a surface ~~and~~ of the fabric,

capturing different reflected images of the surface of the fabric with the camera,

analysing the ~~captured~~ reflected images captured to derive values of parameters of the surface based on ~~the~~ intensities of light reflected from a number of evenly distributed points ~~of~~ on the surface.

2. (Amended) ~~A~~The method ~~of 3D measurement, evaluation and grading system for fabric/textile structure/garment appearance~~ according to claim 1, including ~~using~~ shining four different parallel light beams onto the surface of the fabric.

3. (Amended) ~~Apparatus~~An apparatus for ~~3D~~ three dimensional measurement, evaluation, and grading ~~system for~~ of fabric/textile structure/garment appearance, the apparatus including:

a digital camera ~~arranged to be~~ mounted above a piece of fabric,

means to shine at least two inclined different parallel light beams onto a surface of the fabric below the camera,

means for analysing images of the fabric captured by the camera, and

a computer programmed to derive values of P and Q from the ~~captured~~ images captured, where P and Q are summations of surface gradients for a plurality of evenly distributed points in an x direction and in a y direction, respectively, on the surface of the fabric.

4. (Amended) A method of grading fabric/textile structure appearance based on values P and Q, the method ~~comprises~~ comprising:

using a fixed digital camera positioned above a piece of the fabric, shining at least two different parallel light beams from inclined directions ~~on to the~~ onto a the surface ~~and~~ of the fabric,

capturing different ~~reflected~~ images ~~of~~ reflected from the surface with the camera,

analysing the ~~captured~~ images captured to derive values of P and Q, where P and Q are summations of surface gradients for a plurality of evenly distributed points in an x direction and in a y direction respectively, ~~and~~

calibrating P + Q against a subjective grade analysis of the fabric, and

thereafter, using calibrated P and Q ~~to determine~~ and determining the ~~grades~~ grade of the fabric.

5. (Amended) ~~A~~The method of ~~grading fabric/textile structure appearance according to~~ claim 4, including using four different parallel light beams.

6. (Amended) ~~A~~The method of ~~grading fabric/textile structure appearance according to~~ claim 4, in which the surface gradients p and q are derived ~~using equations (7)~~ from

$$\begin{cases} p = \dfrac{I_e E_w - I_w E_e}{I_e E_w + I_w E_e} \cdot tg\alpha \\ q = \dfrac{I_n E_s - I_s E_n}{I_n E_s + I_s E_n} \cdot tg\alpha \\ c = \dfrac{I_e \cdot \sqrt{p^2 + q^2 + 1}}{\sin\alpha + \cos\alpha \cdot p} \end{cases}$$

7. (Amended) ~~Apparatus~~An apparatus for ~~3D~~ three dimensional measurement, evaluation, and grading ~~system for~~ of fabric/textile structure/garment appearance including:

a digital camera ~~arranged to be~~ mounted above a piece of fabric,

means to separately shine at least two ~~inclined~~ different inclined parallel beams onto a surface of the fabric below the camera,

means for analysing separate images of the fabric captured by the camera for each light beam, respectively, and

a computer programmed to derive values of parameters of the surface of the fabric based on ~~the~~ intensities of light reflected from a number of evenly distributed points of the surface.

8. (Amended) ~~Apparatus~~An apparatus for ~~3D~~ three-dimensional measurement, evaluation, and grading ~~system for~~ of fabric/textile structure/garment appearance according to claim ~~8~~ 7, including means for separately shining four inclined ~~different~~ parallel, different light beams evenly distributed with respect to the camera.

Amendments to the abstract:

Abstract ~~(Figure 2)~~

A method of ~~3D~~ three dimensional measurement, evaluation, and grading system for fabric/textile structure/garment appearance, based an values P and Q, is carried out using a fixed digital camera positioned above a piece of the fabric, shining at least two different parallel light beams from inclined directions ~~on to~~ onto the surface of the fabric and capturing different reflected images of the surface with the camera. The captured images are analysed to derive certain parameters ~~relevent~~ relevant to the appearance. In particular, values of P + Q may be used in a grading evaluation, where P and Q are summations of the surface gradients for a plurality of evenly distributed points in an x direction and in a y direction of the surface, respectively.